

Iron Ore

Exploration opportunities in Nigeria



MINISTRY OF MINES AND STEEL DEVELOPMENT

Iron Ore

Exploration opportunities in Nigeria

INTRODUCTION

Nigeria lies approximately between latitudes of 4⁰N and 14⁰N, and between longitudes 3⁰E and 15⁰E. Nigeria has an estimated current population of about 140 million making it the most populous country in Africa and the tenth most populous in the world. The country's economy has witnessed increasing growth in recent years with the gross domestic product increasing by 6.1% from 2006 to 2007.

Nigeria has a long, but discontinuous history of mining and the country was a prominent exporter of tin, columbite and coal. Mining is administered through the Ministry of Mines and Steel Development which is promoting private-sector led development and has initiated deep and wide ranging reforms of the mining sector.

These include:

1. A new mineral policy that will encourage greater private sector participation in an environment of orderly and sustainable development for the exploitation of solid mineral resources..

The focus of this new policy is to take full advantage of the increased international commodity prices and the global resurgences of exploration activities and:

- Achieve a substantial increase in GDP contribution by the minerals sector;
- Generate quality geoscience data;
- Formalise Artisanal and Small Scale Mining (ASM) operators;
- Achieve poverty reduction through ASM operations;
- Generate employment opportunities;
- Create wealth through value addition;
- Increase capacity of mineral based industries;
- Attract private investment capital;
- Facilitate capacity building opportunities in the solid mineral sector.
- Signing into law of a new Minerals and Mining Act 2007 to ensure security of tenure, competitive Fiscal terms and the encouragement of an industry led by private investors.
- A Mining Cadastre Office (MCO) to administer mining titles "with integrity and in a transparent manner on a 'first-come first served' basis."

CONDUCTIVE ENVIRONMENT

Certain basic facilities favorable for conducting business exist in the country.

These Include:

- A fairly developed infrastructure such as road network, deep ocean ports and jetties.

- Improved communication systems
- Support banking institutions
- Relaxation foreign exchange for capitals raising
- Existing joint venture opportunities
- A large community of skilled geoscientists and engineers
- A commitment to privatization



National Iron Ore Mining Company, Itakpe, Kogi State, Nigeria

OCCURRENCE:

Two broad types of iron ore occur prominently in Nigeria. They are:

- (i) Banded iron formation which occur in folded bands and lenses associated with the Precambrian metasedimentary schist belts prominently outcropping in the western half of the country. Prominent locations include Tajimi, Itakpe, Ajabanoko , Ochokochoko Toto, Farin Ruwa, Birnin Gwari, Maru, Jamare, Kaura Namoda, Kakun, Isanlu, Roni and Ogbomoso areas
- ii The Cretaceous sedimentary(oolitic) iron deposits, occur prominently around Agbaja, Kotonkarfi, Nsude areas in the North central and south eastern zones of the country respectively.

GEOLOGICAL SETTING AND MINERALISATION

In simplified terms, the Precambrian rocks of Nigeria may be grouped into three principal subdivisions. These are the

ancient gneiss migmatitic complex, the schist belts and the plutonic series plus affiliated minor rocks which bear imprints of Liberian (~2700Ma), Eburnean (~2000Ma), and Pan African (~650Ma) tectonic events, The latter being the most widespread. Older ages >3.0Ga have more recently been indicated from some. Such relict signatures tend to reinforce the assertion that this Precambrian terrain may have been part of an Archaean proto shield which was later affected by Proterozoic crustal activities and subsequent evolution of the Phanerozoic basins. Overlying these older assemblages are sedimentary sequences of Cretaceous to Tertiary ages deposited in five basins notably Mid-Niger basin, Benue Trough, Anambra Basin all of Cretaceous ages and the Sokoto (Illumedden Basin), Chad and the Niger Delta basin of Tertiary and Tertiary to Recent ages respectively.

The banded iron formation of Nigeria generally occurs in metamorphosed folded bands, associated with Precambrian basement complex rocks which include low grade metasediments, high grade schist, gneisses and migmatites. Included in these group are the well known Lokoja Okene District (LOK) occurrences notably at Itakpe, Ajabanoko, Kakun, Chokochoko, Toto Muro and Tajimi. In the north western parts of Nigeria, the banded iron formation occurs sporadically in narrow bands and lenses interbedded with pelitic and semi pelitic phyllites and schists. In some cases, especially around Tsofon Birinin Gwari they are interbedded with garnet-quartz mica Schist, lenticular bodies of orthoquartzites and carbonaceous schist. While in Maru area, they are inter-bedded with massive green phyllites, feebly developed slaty rocks, flaggy tuffaceous materials and amphibolites. The iron formation bands which vary in

thickness from about 3 centimeters to 5 meters are found commonly in groups intercalated within surrounding country rocks or as isolated thin units. The bands have variable strike extent with some stretching though discontinuously for several kilometers.

Three main facies have been identified: They are the oxide, silicate and sulphide facies. The oxide facies which is represented by the silica iron oxide assemblage, is the most widespread of the iron formation facies. It



	Deposit or Occurrence	Geological origin		Ore type	Total Fe(%)	Fe in concentrate	Estimated Resource (million tones)	
1.	Itakpe	Precambrian metasedimentary iron formation		Magnetite- hematite	36.5	65	310	
2.	Ajabanoko				37.0	65	60	
					40.0	64	60	
3.	Agbado-Okudu				22.58		20	
4.	Tajimi						30	
5.	Anomaly K-3				33		20	
6.	Anomaly K2				45		12	
7.	Ochokochoko							
8.	Akoina							
9.	Agbaja	Sedimentary Oolitic		Geothite and Hydrothite	47.8	52.1	3705,000	
10.	Patti							
		SiO ₂	Al ₂ O ₃	P ₂ O ₅	S	FeO	Fe (total)	Fe (in concentrate)
1.	Itakpe	44.0	9.6	0.18	0.05	2.25	36.5	65
2.	Ajadanoko	36.0	3.5	0.07	0.05	2.50	37.7	65
3.	Ochokochoko	45.6	6.4	0.007	0.08	11.90	33.5	—
4.	Agbado-Okudu	35.0	0.4	Trace	0.03	1.90	40.0	64
5.	Agbaja-Patti	8.55	1.0	0.9-1.5	—	—	47.8	52.1

Table 1 showing important geological and chemical characteristics of some of the ore deposits

usually consists of a thinly banded but occasionally slaty rock having a rhythmic alternation of light coloured (light gray) silica rich bands of variable thickness. The silicate facies is quartz-garnet-grunerite assemblage. The sulphide facies occurs as the pyrite bearing members of the pelitic metasediments which consists of carbonaceous schist and phyllite, green phyllite and slaty rock. These rocks are invariably interbanded with the oxide iron formation.

The Cretaceous sedimentary iron formation.

Although they are described as sedimentary, they are in fact partly lateritic in character. So far only two of such deposits have been investigated in details and they include the oolitic iron stones of the Agbaja Plateau and the rubbly iron stone of Enugu. Similar iron stones have been found as caps of varying dimensions on some Cretaceous successions of the Illumedun and Niger embayments notably around Koton karfe and Bida basin.

The Lokoja- Okene Iron Ore deposit (Central Nigeria)

The most notable iron ore occurrence in this region include Itakpe, Ajabanoko, Ochokochko, Tajimi, Agbado-Okudu, Ebiya, Ero, Echakaraku, Ozenyi, Udiarehu and some others. They occur as bands and lenses of banded (and sometimes massive) iron formation dipping between 21° and 85° and mostly conformable to the host rocks (gneisses and amphibolites). The tabular ore bodies, up to 45m thick, and extending for distances from hundreds of meters to over 5km, are developed to a depth of over 300m, and are often displaced by small to large faults, (Fig1)

The ore are mostly magnetite and/or hematite with quartz, biotite and amphiboles in the groundmass, iron content ranges between 15% and 65%, averaging 30-36%. Table1 shows important geological and chemical characteristics of the most notable ore deposits.

- (i) Rich ores with more than 50% Fe, and constitutes about 4.5% of the total reserves.
- (ii) Medium grade ores, with 30-50% Fe, and constitutes about 85.4% of the reserve.
- (iii) Lean ore, with 25-30% Fe, which constitutes 13.1% of the reserve.



Ajaokuta Steel Complex: Utilizing iron ore from Itakpe mines

BIF Occurrences in northwestern Nigeria.

The numerous occurrence of banded iron formation associated with the metasediments of the schist belt areas occur sporadically in minor bands and lenses. These locations extend from Tsofon Birni Gwari -Farinruwa to south of Birni goga, and west of Kaura-Namoda, Baraba hills, 5km west of Maru, Koriga river, kalangai and Jamare areas. (Fig) Magnetite and hematite are the major ore constituents in variable percentages. Average ore grade is usually between 38.9 -57.4% Fe₂O₃

BIF occurrences in south western Nigeria

Three occurrences of iron bodies at Oko, Gbede, Ajashe have been mapped around Ogbomosho area as narrow lenses and bands. They are mostly hematite, magnetite iron formation with an Fe grade of 34.4% at Oko, 42.7% at Gbege and 39.0% at Ajashe. They are extensive laterally enough to attract detailed economic evaluation. Although the thickness of occurrence have not yet been ascertained.



Blending Stock Yard, Itakpe



Iron Ore Mines, Itakpe

EMERGING INVESTMENT OPPORTUNITIES

While the Itakpe iron ore deposits are being mined as raw material feeds for Ajaokuta smelting facilities, opportunities for investment in the iron ore resources of Nigeria exist for the deposits in the Northwestern and Southwestern Nigeria. Investors are invited to explore the possibilities of either wholly owning the mineral titles or partnering with existing title holders in exploiting the resources for economic development of Nigeria.

Investment opportunities abound in the following areas:

1. Applying for mineral titles with a view of wholly owning the mining rights for the iron deposit
2. Partnering with existing title holders for detailed exploration as consultants and specialists
3. Partnering with existing title holders in joint venture agreement to explore, mine and market the iron ore resources of areas of interest
4. Legal transaction in iron ore won in quarries and operations for export

For Further Enquiries, Please Contact:

Director General

NIGERIAN GEOLOGICAL SURVEY AGENCY

31 Shettima Monguno Crescent
Behind Julius Berger Office, Utako District
P.M.B. 616, Abuja, Nigeria.

Email dgoffice@ngsa-ng.org

CUSTOMERS SERVICE CENTRE

NIGERIAN GEOLOGICAL SURVEY AGENCY

+234 (0) 8053000184, 234 (0) 8065901938

E-mail: customer-enquiries@ngsa-ng.org

contactus@ngsa-ng.org

Supported by
World Bank Assisted

**SUSTAINABLE MANAGEMENT OF MINERAL RESOURCES
PROJECT (SMMRP)**

No 6, Marte Close,
Off Misau Crescent,
Garki II,
Abuja

MMSD 2010